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Circulating Microparticles Alter Formation, Structure, and Properties of Fibrin Clots

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Abstract

Despite the importance of circulating microparticles in haemostasis and thrombosis, there is limited evidence for potential causative effects of naturally produced cell-derived microparticles on fibrin clot formation and its properties. We studied the significance of blood microparticles for fibrin formation, structure, and susceptibility to fibrinolysis by removing them from platelet-free plasma using filtration. Clots made in platelet-free and microparticle-depleted plasma samples from the same healthy donors were analyzed in parallel. Microparticles accelerate fibrin polymerisation and support formation of more compact clots that resist internal and external fibrinolysis. These variations correlate with faster thrombin generation, suggesting thrombin-mediated kinetic effects of microparticles on fibrin formation, structure, and properties. In addition, clots formed in the presence of microparticles, unlike clots from the microparticle-depleted plasma, contain 0.1-0.5-μm size granular and CD61-positive material on fibres, suggesting that platelet-derived microparticles attach to fibrin. Therefore, the blood of healthy individuals contains functional microparticles at the levels that have a procoagulant potential. They affect the structure and stability of fibrin clots indirectly through acceleration of thrombin generation and through direct physical incorporation into the fibrin network. Both mechanisms underlie a potential role of microparticles in haemostasis and thrombosis as modulators of fibrin formation, structure, and resistance to fibrinolysis.

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